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ABSTRACT

This study examined how the science methods program at the University of Nebraska, Lincoln affected pre-service elementary teachers' attitudes toward teaching science. A pretest/posttest design was used to evaluate the change in attitude over the course of the semester. Results of the study indicated that the methods course positively influenced attitudes toward teaching science for all students. A description of the course which provides laboratory and peer teaching experiences is included. (Author/CW)

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THE EFFECTS OF HANDS-ON MINDS-ON TEACHING EXPERIENCES ON ATTITUDES OF PRE-SERVICE ELEMENTARY TEACHERS

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ABSTRACT

The University of Nebraska-Lincoln offers a unique and creative approach to teaching elementary science methods. The science methods class consists of one hour of lecture and two hours of laboratory three times per week. Since the backgrounds of the students are very weak in science, the lectures deal with science content as well as methodology. The laboratories are arranged so that there are approximately 24 students in each lab. The labs deal with such practical topics as maintaining an aquarium and terrarium, utilizing community resources, and exposure and certification in Project Wild, (an excellent outdoor education program). The major emphasis of the lab however is three peer teaching experiences in which the students teach each other lessons drawn from current curriculum materials and from the successful elementary science programs of the 1960's and 1970's.

The current study examines how the science methods program affects pre-service elementary teachers attitudes toward teaching science. A pre-test/post-test design was used in evaluating the change in attitude over the course of the semester. Results of the study indicate that the methods course positively influenced attitudes toward teaching science for all students.

A major concern of science educators across the nation is the lack of time spent on science in elementary schools. As a society we stress that science should be a building block for every student's future. Yet scientific illiteracy is a growing problem nation wide. Since young children formulate their attitudes at an early age, elementary science education is extremely crucial. Elementary teachers feel unprepared to teach science, and spend less time on science than any other subject, (NSF, 1980 p9). Only 22% of all elementary teachers felt well qualified to teach science, while nearly two-thirds felt well qualified to teach reading (NSF, 1980, p.65).

A study in Florida showed that 25% of the 191 teachers surveyed spent no time at all teaching science, and the remaining 75% spent less than 2 hours a week on science (Manning et al. 1982). More than half of the teachers surveyed by Manning ranked science fourth or fifth out of 5 subjects they were to teach. A survey of 74 pre-service elementary teachers at the University of Nebraska produced similar results. When ranking seven curricular areas in order of preference, 37.5% of the students ranked science as fourth or fifth. When asked which of the seven classes did you feel you knew least about (content knowledge), 45.83% said science. Only 2.78% of the students felt that prior to their methods classes that they would rank science as their subject most prepared to teach. For the majority of the students, science presents a concern for them in their professional career as elementary teachers.

Attitudes toward teaching is one of three obstacles most frequently cited by elementary teachers for not teaching science (Hove, 1970). Other researchers have indicated that elementary teachers dissatisfaction with science can be traced to their attitudes toward teaching science. Over half of the elementary teachers surveyed by Manning et al (1981), Mechling (1982), and Westerback (1984), rank science 4th or 5th out of five subject areas. More importantly these teachers view themselves not as facilitators in the science classroom, rather as primary dispensers of scientific facts.

Inadequate science background is commonly given as a reason for teachers' reluctance to teach science (Victor 1961, Blosser & Howe 1969). Schwerian (1969) found a positive association between the amount of college science experience and science understanding. Yet, Shrigley (1974), found a low correlation between science knowledge and teachers' attitudes toward science. Shrigley continues, stating that teachers that did not like science had students that tended not to like science. If the problem confronting elementary teachers of science is their attitudes toward teaching science, it is then our responsibility to begin to look for solutions to these problems.

THE STUDY

The purpose of this study was to determine the effects of a science methods course on the attitudes of the student towards science. This study has been conducted over 4 semesters of methods classes. During those 2 years, instruction of the methods course has not changed significantly.

Description of the Methods Course

At the University of Nebraska-Lincoln, we have developed a creative methods class. It has several characteristics which in and of themselves may not be new, but in combination they produce a very effective program. These characteristics are, blocking of the elementary science and mathematics methods courses, integration of methodology with practicum experiences, peer teaching, emphasis on hands-on minds-on science, and emphasis on technology.

The science methods class consists of one hour of lecture and two hours of laboratory three times per week. Since the backgrounds of the students are very weak in science, the lectures deal with science content as well as methodology. The laboratories are arranged so that there are approximately 24 students in each lab. The labs deal with such practical topics as maintaining an aquarium and terrarium, utilizing community resources, and exposure and certification in Project Wild, (an excellent outdoor education program sponsored by the Western Association of Fish and Wildlife Agencies and the Western Regional Environmental Education Council). The major emphasis of the lab however is three peer teaching experiences in which the students teach each other lessons drawn from current curriculum materials and from the successful elementary science programs of the 1960's and 1970's.

Students are grouped within each lab into six teams. During a lab period one team is responsible for a lesson or series of lessons on a given science topic. Each member of the team must have a significant role in one of the lessons. A second team

provides support. The other four groups serve as students for the lessons. It is the responsibility of the support team to perform the following functions: one person operates the camera and videotapes the lesson; another observes the non-verbal communication of the teacher; a third person analyzes the questioning behavior of the teacher; a fourth codes the lesson utilizing the Flanders Interaction Analysis system or a SATIC-B code developed for computer use. Each member of the support team subsequently provides objective feedback to the teacher regarding these areas. In addition, a graduate student is responsible for evaluating the lesson and providing feedback.

One of the major advantages of this methods course is the opportunity to devote two to three weeks of time to a practicum experience in a local school. Students are assigned in teams of four to a cooperating teacher. They are responsible for teaching a unit of science and/or mathematics for this period of time. The team teaching is an excellent opportunity to develop cooperative teaching strategies. The leadership role is rotated among the members of the team, but all members have significant responsibilities for each lesson.

Heavy stress is placed on the importance of hands-on learning experiences and mind capturing events for children. Peer teaching lessons are drawn from curriculum materials that emphasize this approach.

THE INSTRUMENT

Attitude data was collected at the first and the last class meetings using the the Science Attitude Scale, revised by

Thompson and Shrigley (1984). The attitude instrument is a revised attitude scale based on the original Science Attitude Scale published about 2 decades ago, (Shrigley, 1972). There are twenty-two items, 12 positively-written and 10 negatively-written. It is a five choice, Likert-type science attitude scale for pre-service teachers.

PROCEDURE

The instrument was administered during regular class time by a research assistant. Each student was given an explanation that the purpose of the research was to improve the quality of the instruction at the University of Nebraska-Lincoln. The Science Attitude Scale was administered the first and last regular lab periods of each of the respective semesters.

Samples

For all four of the semesters in which data was collected, the subjects were pre-service elementary teachers enrolled in science methods at the University of Nebraska-Lincoln. A total of 145 students participated over the course of two years, on the attitude scale.

Results and Discussion

In this study, several research questions were answered. (1) Were attitudes toward science changed in a positive direction? An evaluation of the differences between the pretest and the post-test measure of attitude was done to answer this question. The evaluation was accomplished by using a t-test of the pairs for the dependent variable attitude. There was a significant difference, pretest-post-test for the attitude measure, $t(1,144)=-9.01$, $p<.001$ (see table 1). This change in

attitude was in a positive direction, and would suggest that the attitude of the students participating in this methods class were affected by activities in which they were involved.

(2) Was the positive change in attitude for the students consistent for high achievers and low achievers? This question investigates the difference between attitudes for high achievers and low achievers. A t-test was performed on the dependent variable pairing the high achievers and low achievers together in each of the pretest-post-test situations. The results would indicate that on the pretest there was no significant difference between the attitudes of the high and low achievers, $t(1,59)=1.63$, $p>.01$ (see table 2). This would indicate that the upper 10% of the class, (based on final grade) showed no difference in their attitudes as compared to the bottom 10% on the pretest examination. The t-test on the post-test indicated no significant difference between the high achievers and low achievers, $t(1,31)=1.27$, $p>.05$ (see table 3). This would indicate that attitudes of the students both pretest and post-test were homogeneous. The attitudes of the students were changed over the semester involvement in the class and would indicate that all students attitudes were affected in a positive manner.

CONCLUSIONS

The results of this study lend support to the notion that teaching experience with inquiry oriented, hands-on, process-approach science activities may affect the attitude of the students toward teaching science in a positive manner. It is

clear then, that the mean attitude levels of the students in the study were affected in a positive direction. This supports Morrisey's (1981) results which indicate that teachers' attitudes can be improved by taking courses that specifically include hands-on activities. The goal of generating more effective elementary science teachers may be accomplished by changing the attitudes of the students toward teaching science in a positive manner. Low and high achievers both benefit from the participation in the current methods class. There is no discrimination between the levels of achievement. Both ends of the extreme ends analysis group (upper 10% and lower 10%) changed their attitudes in a positive manner. Most importantly the lower achievers attitudes toward science teaching on the post-test measure were not significantly different from the high achievers on the post-test measure. This ensures that each individual is affected by the course in a positive manner. This supports Shrigley's (1974) conclusions that science knowledge and attitudes toward teaching science are not neccessarily related. Support is given by this study to the assumption that hands-on, minds-on, inquiry oriented process approach to science activities, may affect attitudes in a positive manner.

TABLES

Table 1
t-Test Analysis for Pretest/Post-test on Attitude Toward Teaching Science for Pre-service Elementary Teachers

	MEAN	STD.DV	t-VALUE	df	PROB.
PRETEST	76.46	8.98	-9.01	144	<.000
POST-TEST	82.68	7.90			

Table 2
Extreme Ends Analysis by Pairs of Pretest (Upper and Lower 10% on Final Grade) for Attitudes Toward Teaching Science on Pre-service Elementary Teachers.

	MEAN	STD.DV	t-VALUE	df	PROB.
UPPER 10%	79.19	7.90	1.63	59	.107
LOWER 10%	75.38	10.28			

Table 3
Extreme Ends Analysis by Pairs of Post-test (Upper and Lower 10% on Final Grade) for Science Attitude on Pre-service Elementary Teachers

	MEAN	STD.DV	t-VALUE	df	PROB.
UPPER 10%	84.81	7.78	1.27	31	.212
LOWER 10%	80.92	9.55			

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